APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/600,044	06/20/2003	Chris H. Wood	59673-31	5559

22504   7590   06/26/2009
DAVIS WRIGHT TREMAINE, LLP/Seattle
1201 Third Avenue, Suite 2200
SEATTLE, WA 98101-3045

EXAMINER
LAMPRECHT, JOEL

ART UNIT	PAPER NUMBER
3737	

MAIL DATE	DELIVERY MODE
06/26/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 April 2009*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37 and 39-50* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37 and 39-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of

the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation

under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g)

prior art under 35 U.S.C. 103(a).

Claims 1-5, 12-15, 21, 22, 29, 35-37, 39-41, and 47-50 are rejected under 35

U.S.C. 103(a) as being unpatentable over Thevenaz et al. (IEEE Transactions on image

processing Vol 7, No 1, Jan 1998) in view of Hibbard et al (US 6,266,453 B1).

Regarding Claims 1-5, Thevenaz et al. disclose a registration method comprising

an iterative loop which estimates patient motion within a set of medical images *after* a

resampling has been performed. The motion estimation taking place in a directional

axis and corresponding to a lowest image resolution (Page 27 Col 2), and using an estimated motion procedure in a three dimensional rigid-body transformation (Page 29 Col 1 & 2). Additionally, a correction threshold is used to compare estimated patient motion and resampling based upon that comparison (Page 28 Col 1, and Page 29-30).

Regarding Claims 12-15 and 50, iterative loops of Thevenaz et al. disclose a resampling where in the event that patient motion equals or exceeds the threshold it uses one resampling procedure (a three dimensional image resampling), and performing a second image resampling procedure in the event that the estimated patient motion is less than the correction threshold (a two dimensional image resampling (Page 29 Col 2 – Page 30 Col 1; also Page 27 Col 1).

Regarding Claims 21 and 22, it is inherent that if a method is setup to perform a function as in Claim 15, the program, media, or method used from Claim 15 can be setup to do nothing in the event that the estimation of motion is less than the correction threshold by a set amount. When a threshold is set, as on Page 27 Col 2, 3-D registrations, as well as simpler transformations cannot be preformed, of which avoiding an image resampling would be a much easier procedure than performing one.

Regarding Claims 29, 35-37, 41, 47-49, it is inherent that both a computer readable medium and a processor are required for MRI/PET 2D/3D registration procedures as it is mandatory to have both a computer and computer readable medium to be able to process the vast arrays of numbers and calculations taking place during a medical imaging procedure.

Thevenaz et al disclose the invention as claimed, except for the fact that the

iterative process disclosed performs a resampling before the motion estimation is

calculated for the first time and does not explicitly disclose the use of an MRI system for

acquisition of the images. Attention is then directed to the secondary reference by

Hibbard et al which discloses the use of a motion estimation procedure which performs

an estimation of the in-plane versus out-of-plane motion of imaging data acquired by an

MRI system before a resampling (Col 5 Line 23-40) is performed in selectively two or

three dimensions (Col 12 Line 60—Col 13 Line 63, Col 15 Line 30 – Col 16 Line 65,

Specifically, Col 16 Lines 45-51). It would have been obvious to incorporate the

processing methods of Hibbard et al in the applications of Thevenaz et al for the

purpose of reducing unnecessary calculation time and processing as performed by the

system (Col 7 Line 30-60).

Claims 6-11, 16-20, 23-28, 30-34, and 42-46 are rejected under 35 U.S.C. 103(a)

as being unpatentable over Thevenaz et al. in view of Hibbard et al. as applied to claims

5, 15, 22, 29, and 41 above and in further view of Hill et al.

Regarding Claims 6-11, 16-20, 23-28, 30-34, and 42-46 Thevenaz in view of

Hibbard discloses all that is listed above, but does not touch on specific thresholding

parameters, even though in a pyramid registration and deblurring it is hinted that the

threshold is some fraction of the image resolution. In addition, Hibbard does not

disclose accuracy to the level as required by the instant application (Col 10 Line 65 -

Col 11 Line 8). Attention is then directed to the reference by Hill et al. which discloses a

majority of the same information disclosed by Thevenaz in view of Hibbard, but also discloses more in depth descriptions of registration. Hill et al. discloses a method of finding a correction threshold in Section 11 where images are compared and corrected to a standard, a standard which can be as accurate as .5mm in size, much smaller than the .75mm suggested as a 0.5 fraction of a slice thickness from the Applicant's specification. Utilizing the error calculations disclosed in Section 11, as well as the logic in the first sentence from Section 11, it would have been obvious to on having normal skill in the art at the time of the invention to use the methods of comparing blurriness, and translation suggested by Hill et al. with the methods of convergence by Thevenaz in view of Hibbard in order to quantify whether a particular image is within a correction threshold and would be "sufficiently accurate" for a given application, thereby discerning which algorithm to utilize.

Regarding Claims 11 and 28 Thevenaz in view of Hibbard does not disclose characterizing an image signal relative to a background. Attention is directed then to section 10.3.1 from Hill et al. for a disclosure of signal intensity characterization relative to a background, a precontrast ISI, and post contrast ISI. It would have been obvious to one in the art to use the methods disclosed by Hill et al. with the disclosure of Thevenaz in view of Hibbard in the same area of endeavor, in order to facilitate registration with accurate representation of spatial resolution without interference by a background.

Regarding Claims 9, 10, 19, 20, 26, 27, 33, and 34 the Examiner has interpreted the Claims to read an "image resolution along a lowest image resolution axis" as some size of pixels or voxels in the smallest direction. Thevenaz in view of Hibbard discloses

a method for computing a correction threshold where multiple algorithms can be

selected based on the Marquardt-Levenberg algorithm (see Section 3) but does not

disclose a correction threshold along a lowest image resolution axis. Attention is then

directed to the secondary reference by Hill et al. which discloses a method for

computing the accuracy of the resolution down to .5mm, which, in light of the

specification, corresponds to a fraction of the voxel/pixel resolution along the lowest

resolution axis. Therefore, it would have been obvious to one having normal skill in the

art at the time of the invention to have incorporated the accuracy measures described in

Hill et al. with the threshold selection process of Thevenaz in view of Hibbard in order to

utilize multiple algorithms selectively during a medical image registration.

Response to Arguments

Applicant's arguments filed 4/16/09 have been fully considered but they are not

persuasive with respect to the art of record **(New arguments responded to in bold)**.

With regard to the argument that Hibbard et al is not applicable to the current recitation

of the claims, Examiner respectfully disagrees. The teachings of Thevenaz et al clearly

show that motion estimation is performed, even though there is a resampling before

motion estimation, and the iterative process is relied upon for the method.

The teachings of Hibbard as they relate to the current claims are used to first

teach that MRI images are used and secondly to disclose a measure of motion as

relates to image processing. Hibbard does not explicitly mention patient motion, rather

discloses the technical aspects of estimation of differences between frames of image

captures. A comparative difference of images taken at temporally different intervals or

times necessarily will involve some aspect of patient motion as it would be impossible to

have the exact same positioning or capture at two different periods in time.

　　　　Additionally, Applicant has *not precluded multi-modality sets* of captures

from the present claimset. As currently claimed, only adaptive registration of a

set of images is required where they MAY be motion occurring during the

acquisition of the data. The estimated amount of patient motion (and of course

as a result, image differentiation or distortion) is the guide as to which process is

performed (2d or 3d or none at all). The differentiation between in plane and out

of plane resampling as well as focus on elimination of unnecessary computation

within the Hibbard reference apply to image data, same as with that of the

Thevenaz et al reference, and while it is worth noting that the end-result is a

fusion of multi-modality images into an image representative of internal

anatomical features, the procedure for registration and resampling is based off of

"error" or "displacement vector" calculations, the same as with motion distortion.

　　　　Thus, as mentioned by Applicant, the scaling, rotation, and transformations which

are disclosed within Hibbard are used to align images which have data points that are

different (see motion of a patient as a cause for this). The measure of the difference of

multiple image captures in two and three dimensions to decide which sort of a

resampling procedure should be used is then a data-based method of performing an

estimation of motion or difference between images and accordingly aligning the images.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL M. LAMPRECHT whose telephone number is (571)272-3250. The examiner can normally be reached on 8:30-5:00 Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian L. Casler can be reached on (571) 272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRIAN CASLER/
Supervisory Patent Examiner, Art
Unit 3737

JML